

Welcome to
(the other)
Cambridge!!

And to our summer workshop:
Accretion in Stellar Systems



News from *Chandra*

Belinda Wilkes
Director
Chandra X-ray Center



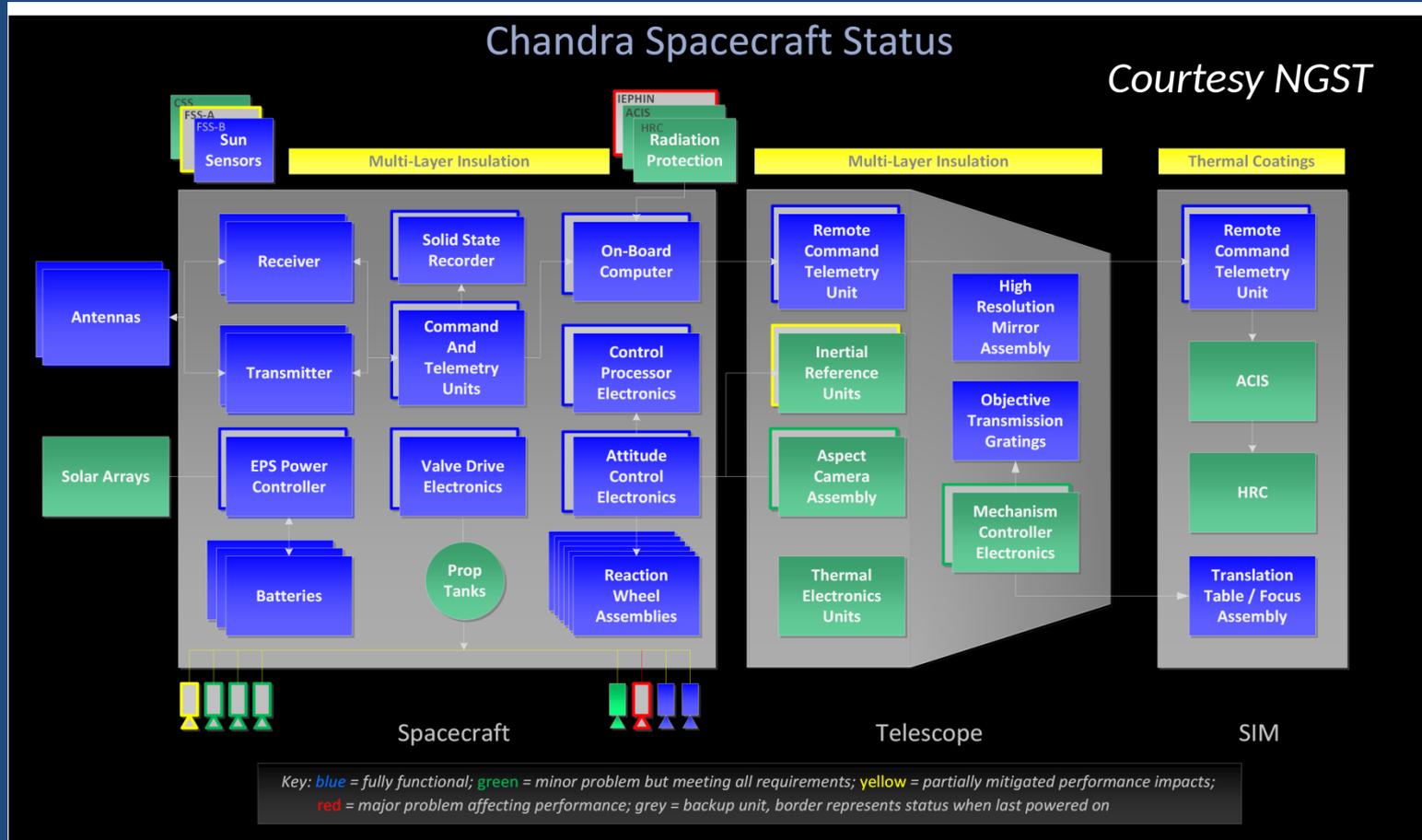
Basic Information

- ~3 day orbit
- ~70% observing efficiency (~16-18 hr radzone)
- Mission Planning:
 - 1-week schedule, DSN COM every 8 hrs
- Resolution:
 - Spatial ~0.5"
 - Spectral, gratings: ~200-1000; 0.1-10 keV
 - Highest time resolution, HRC: 60 μ s
- 25+ year lifetime expectation



Chandra: 19 years and counting!

Detailed 2014 engineering review showed no show-stoppers to **10(+)** more years of observing



*****Little red or yellow!*****

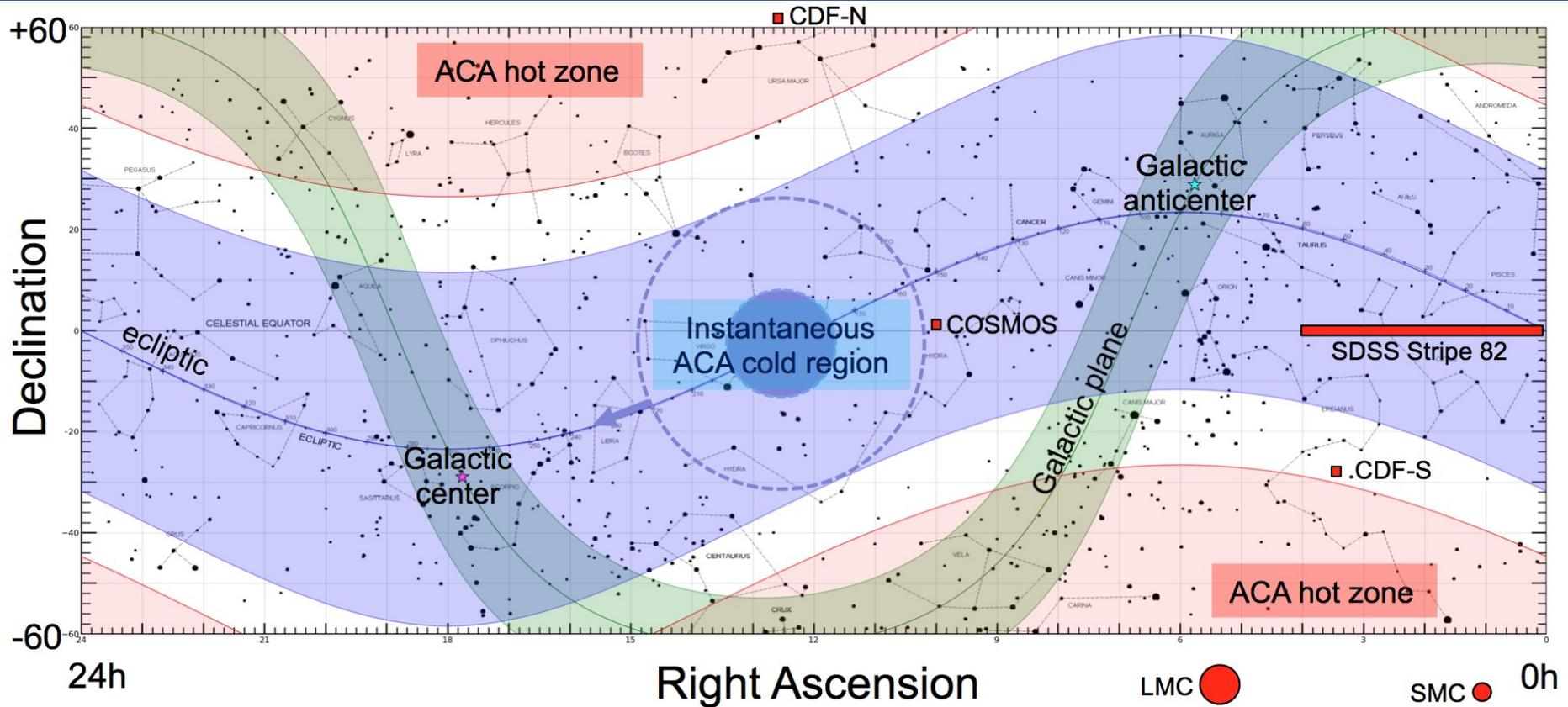


Chandra Challenges

- Thermal degradation:
 - Spacecraft insulation is degrading → general warming
 - Monitor, and predict temperatures of many components
 - Limits dwell time over most solar pitch angles
 - Complex scheduling:
 - Limits on constrained time to maintain an efficient schedule
 - Long exposures are split into multiple shorter ones
 - Restrictions on observing time:
 - VLPs < 2Msec observing time close to ecliptic poles
 - **Upcoming Call for White Papers**
 - Asking for suggestions of catalogs of cool attitude targets
- Contaminant build-up on ACIS OBF
 - Significantly reduced $A_{\text{eff}} < 2 \text{ keV}$ since launch
 - Longer exposures for science requiring low energy data
 - Buildup of contaminant has slowed, updated effective areas being released



Constraints on the Sky due to thermal degradation



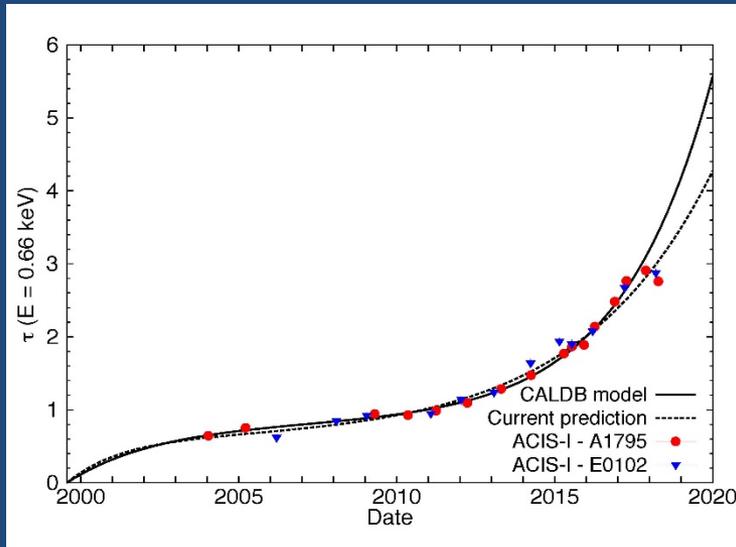
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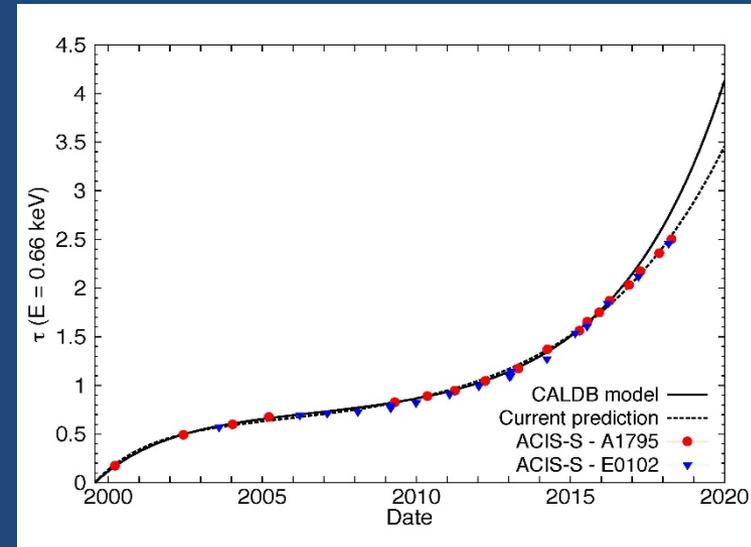


ACIS Filter Contaminant slows buildup

ACIS-I



ACIS-S

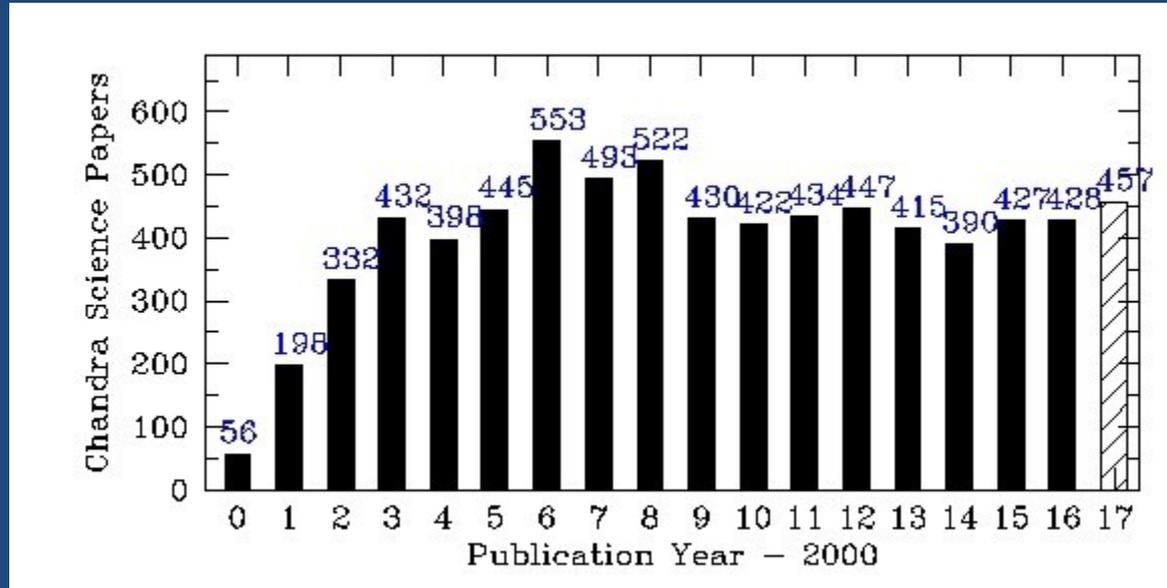


- ACIS-I
 - The rate of contaminant build-up is consistent with ~ 0 since mid 2017
 - Updated model released: June 2018
- ACIS-S
 - The rate of contaminant build-up has significantly slowed since mid 2017
 - Updated model in development, expected release \sim early Sept 2018



Chandra's continued high impact on astrophysics

Refereed papers per year



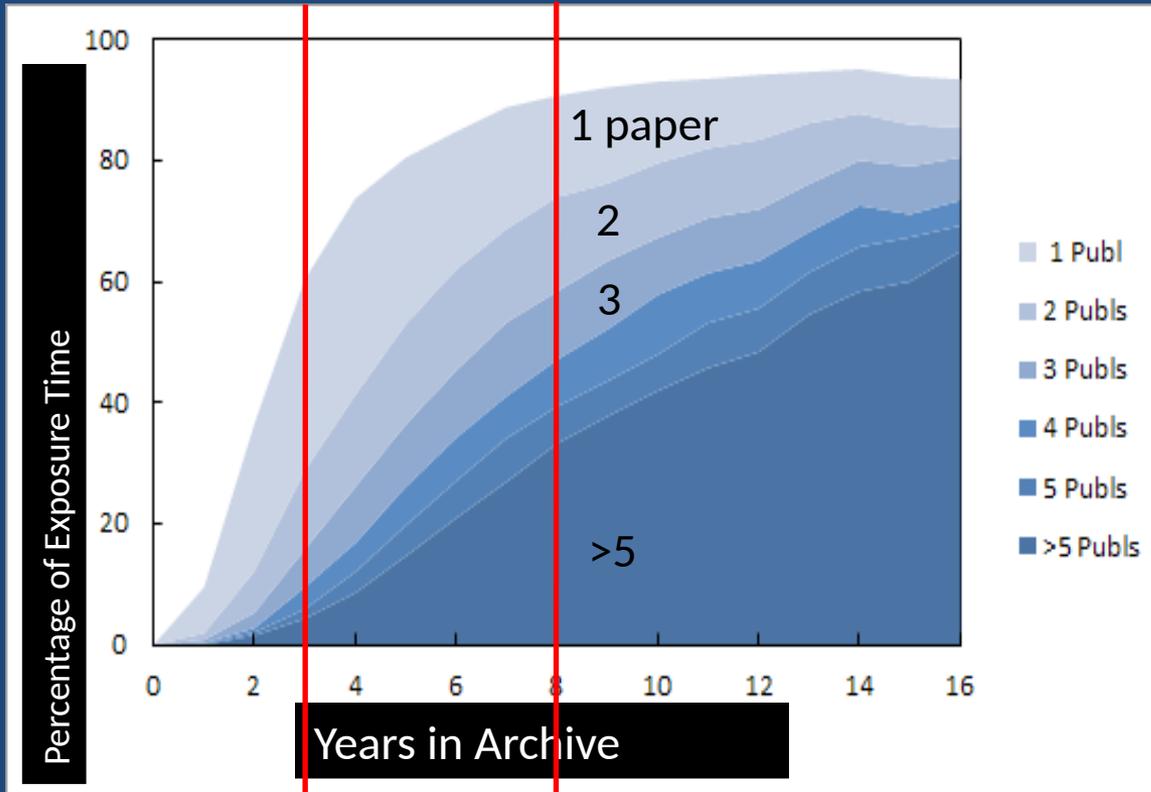
Refereed science papers

- 7299 total Chandra papers (to 07/01/2018)
- 450 mean # papers/year (2005-2017)
- 35 mean # citations/paper after 6 years (84 after 14 yrs)
- >320 PhD theses (worldwide)



Metric measuring productivity and data utilization

*% of data published in # refereed papers
vs. # years in archive*



Rots et al. (2012)

Publications:

- Median time to publication: 2.4 yrs
- After 3 years: 60% of data are published in 1 or more papers
- After 8 years: 90% of data are published in 1 or more papers, 60% in 3 or more

Science covers full range of astrophysics: Cosmology, black holes, clusters, galaxies, stellar birth and death, exo-planets, planets (including Pluto (New Horizons), Jupiter (Juno))



Chandra 20th Proposal Cycle

Category (Cycle 20)	Exposure Time Allocation (Ms)
General Observer	10-12
Large Projects (>400 ks)	4-6
Director's Discretionary	1
Joint*	~ 2.5 weeks of time
Archive	\$1M*
Theory	\$650K*
Very Large Projects (> 1 Ms)	=<3 (none awarded)
Past Categories:	
X-ray Visionary Projects (> 1 Ms)	5-8 (enabled by orbit evolution)

*XMM-Newton, HST, NRAO, NOAO, Swift, NuSTAR

*Total GO Budget: ~\$11M



Major *Chandra* Events

- NASA Contract Extension: 2018-2030, inc 3 year close-out
- NASA Senior Review (SR2019)
- Operations Control Center moving to Burlington, MA
 - Major activity at OCC, in addition to satellite operations
 - Construction in process, early access was gained last week
 - Aim to complete ~March 2019
- **20th anniversary year: 2019!!**
 - AAS Jan: 4-space booth, new products, press reception, plenary talk, AAS/HEAD Chandra session
 - “The *Chandra* X-ray Observatory” (e-book, IoP): review of 20 years of *Chandra* science for the community
 - *Chandra*’s Greatest Hits coffee table book, Smithsonian books (TBC)
 - 20 years of *Chandra* science symposium: 3-6 Dec 2019, Boston Park Plaza
 - Many physical and virtual events being planned throughout the year!

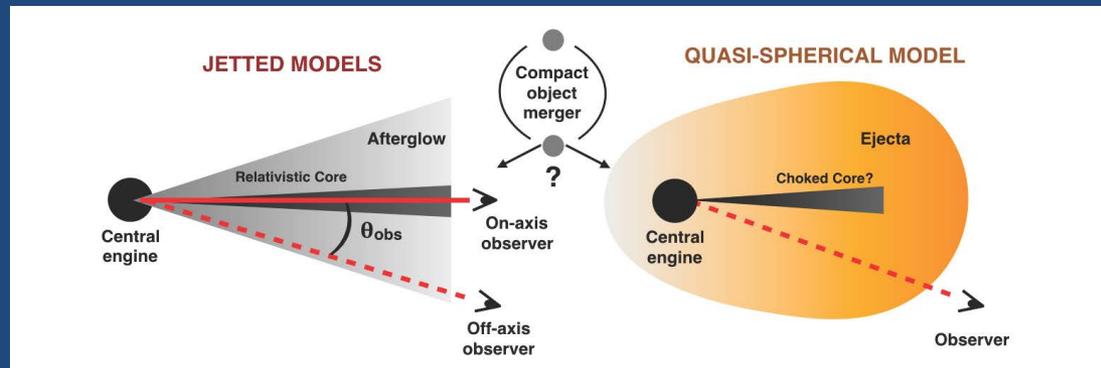
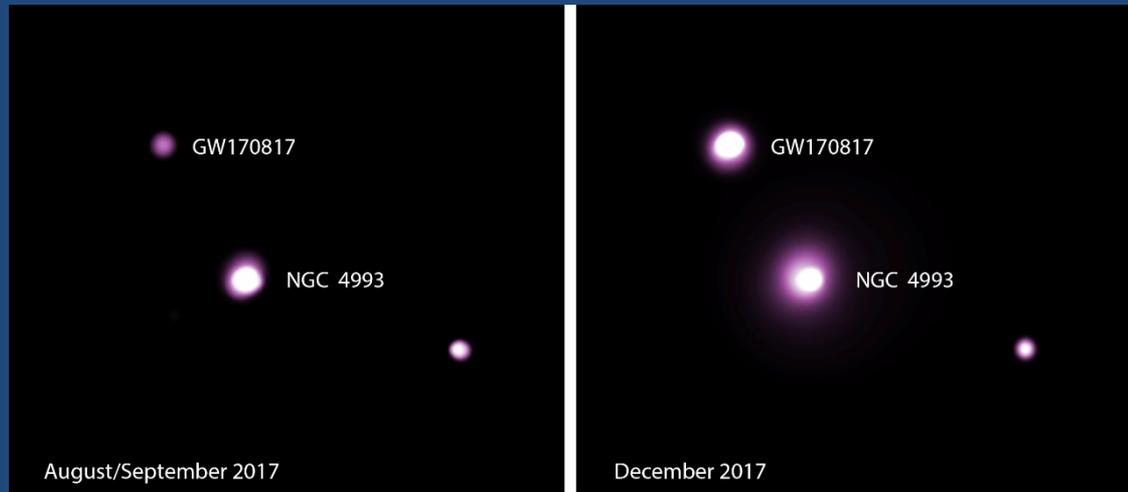


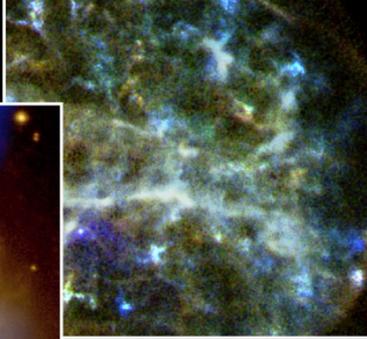
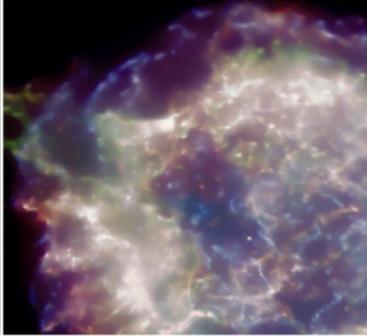
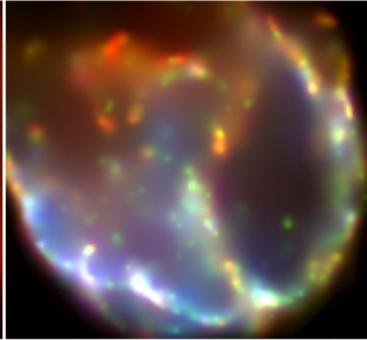
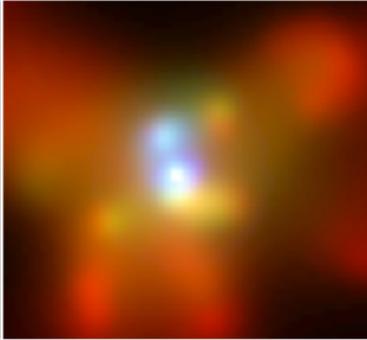
Science Highlight

Merging NSs: GW170817

Tracking by *Chandra* continues:

- Undetected 2 days >LIGO
- Detected 9 days >LIGO
- Press conference, Oct 16
- Brightened ~ 4 , w/radio
- Competing non-thermal models
- Possible turnover detected
- Remnant is likely a BH
- Next observation: Aug '18 (this week!)





Public website:
chandra.si.edu

Backup Slides



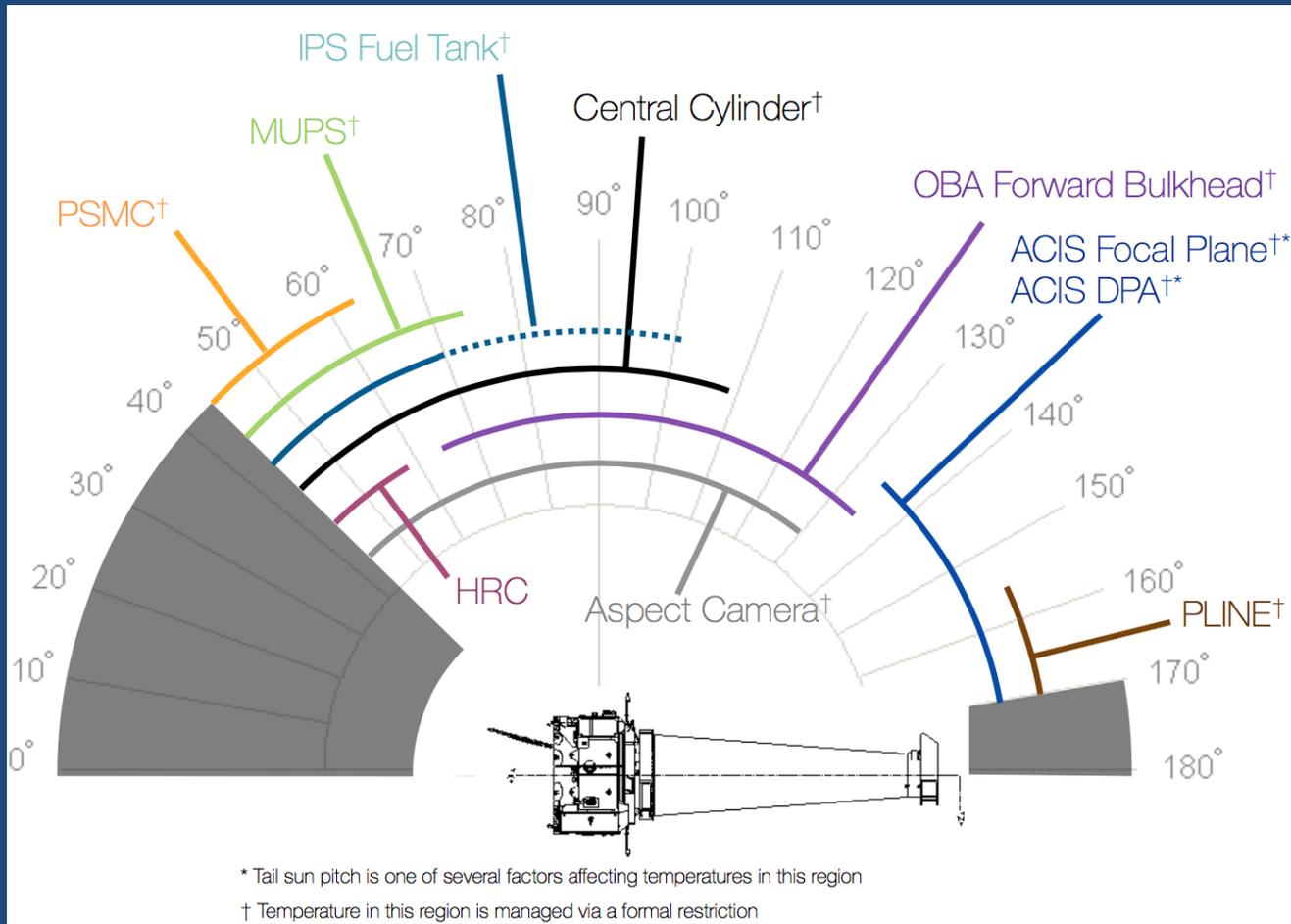
Thermal issues in aging spacecraft

- Insulation is degrading → general heating
- Temperature managed via spacecraft attitude control
- Many subsystems monitored continuously
- Limited dwell times at most pitch angles
- Scheduling is complex, most observations are split
- So far only one limit on time allocation: $< 2 \text{ Ms } > 60^\circ$ ecliptic latitude



Thermal issues in aging spacecraft

Limited dwell times at ~all pitch ranges



Time Constraints (TC)

- Limit # TC observations (<90ks) → maximize observing efficiency
- Categories (Cycle 19):
 - Easy (48), Average (25), Difficult (17)
- Demand is high → most passing-ranked TC proposals are approved

